U.S. Department of Energy
and the
National Science Foundation

MAR 3 2006

Professor Melvyn J. Shochet
Chair, HEPAP
Enrico Fermi Institute
University of Chicago
5630 S. Ellis Ave.
Chicago, IL 60637

Professor Garth Illingworth
Chair, AAAC
Department of Astronomy and Astrophysics
University of California, Santa Cruz
1156 High St.
Santa Cruz, CA 95064

Dear Professors Shochet and Illingworth:

We are requesting that the High Energy Physics Advisory Panel (HEPAP) and the Astronomy and Astrophysics Advisory Committee (AAAC) form a joint subpanel to provide advice on priorities and strategies for the direct detection and study of the dark matter that dominates the mass of the universe. This request is made within the context of the report of the interagency working group, entitled "The Physics of the Universe—A Strategic Plan for Federal Research at the Intersection of Physics and Astronomy," produced under the auspices of the Office of Science and Technology Policy. Specifically, we ask that HEPAP and AAAC establish a Dark Matter Scientific Assessment Group (DMSAG) to advise the National Science Foundation Divisions of Physics and Astronomical Sciences and the Department of Energy's Office of High Energy Physics on matters concerning the U.S. dark matter research program.

There has been a growing recognition of the compelling scientific opportunities emerging at the interface between physics and astronomy. In particular, great importance has been assigned to the detection and understanding of the mysterious dark matter that dominates the mass of the universe, a scientific area that is of central importance to both particle physics and astronomy. A number of studies over the last few years (*Quarks to the Cosmos, Quantum Universe, The Physics of the Universe, etc.*) have all identified the compelling discovery opportunities in the area of dark matter, and the physics and astronomy communities have put forward numerous projects designed to directly detect or systematically map the effects of dark matter in the cosmos.

The time has come for the science agencies to develop a coherent plan of specific steps to be taken to address this important scientific theme; and it is for this purpose that we seek advice from your two committees.

DMSAG will be established as a joint subpanel of HEPAP and AAAC. It will report to HEPAP and AAAC, which will consider its recommendations for approval and transmittal to the agencies. DMSAG will proceed within the context of the extant reports and long-range plans directly impacting on dark matter, and it will conduct meetings at which spokespersons for different approaches present their ideas, as well as closed meetings to deliberate and develop recommendations. To be most useful, we ask that DMSAG provide an interim report by September 1, 2006 and a final report by February 1, 2007.

More specifically, DMSAG is charged to address the following questions:

- What are the most promising experimental approaches for the direct detection of dark matter using particle detectors in underground laboratories? DMSAG should consider technologies such as Ge/Si crystals, liquid Xe, two-phase Xe, liquid Ar, and any other promising technology. Thus the scope of this charge will make it necessary to address techniques that are in very different stages of development.
- The analysis of each approach should address topics such as: relative advantages and disadvantages, stage of development, realistic time to implementation, ultimate sensitivity, realistic limit of scalability, overburden requirements.
- What is the optimum strategy to operate at the sensitivity frontier in the short and intermediate term, while making the investments required to reach the ultimate sensitivity achievable by scaling up to some realistic size in the long term (5-10 year horizon)?
- What is the present state of the worldwide dark matter program, and how would the candidate approaches advance the field in the international context? Does the US program have the potential to make unique contributions to direct dark matter searches in the future?
- What guidance and constraints for this program can be gained from other approaches to understanding dark matter? What implications for this program are likely to come from astronomical observations or theoretical astrophysics and particle physics? How would direct detection by the proposed approaches complement the observation of new elementary particles at TeV-scale colliders? What new understanding would be possible from the combination of these approaches compared to any one of them alone?

We thank you for your help in establishing this joint subpanel. Its deliberations and recommendations will contribute very significantly to the national program in dark matter over the next decade. We look forward to working with you in the endeavor.

Sincerely,

Robin Staffin
Associate Director
Office of High Energy Physics
Department of Energy

Michael S. Turner
Assistant Director
Mathematical and Physical Sciences
National Science Foundation